AN EXAMPLE OF EXTREME F. *PAN-ALBISIGNATA*, KAABER & HØEGH-GULDBERG, IN THE DURHAM ARGUS BUTTERFLY, *ARICIA ARTAXERXES SALMACIS*, STEPHENS, AND RELATED OBSERVATIONS.

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THE DURHAM or Castle Eden Argus butterfly, *Aricia artaxerxes salmacis,* Stephens, is a subspecies of the Northern Brown Argus (Jarvis, 1958, 1968, 1969 & 1974; Høegh-Guldberg, 1966; Selman, Luff & Monck, 1973). Over the years many aberrations have been described (Harrison, 1905, 1906 & 1928; Tutt, 1914; Carter, 1922; Carter & Harrison, 1923 & 1929; Harrison & Carter, 1929; Howarth, 1973; Russwarm, 1978). The purpose of this paper is threefold:- (1) To describe a rare aberration in an individual Durham Argus butterfly recently observed (27th June 1994) and photographed in County Durham (VC66) inland at Pittington Hill in the Magnesium Limestone. (2) To report the finding of a single further example of the aberration in the Scottish Northern Brown Argus, *Aricia artaxerxes artaxerxes,* Fabricius, in a local museum, and (3) To give an account of some related observations on the white component of the submarginal lunular markings on the upper wing surfaces of *Aricia* sp.

Description of the aberration

The fresh-looking *A. artaxerxes salmacis* had very dark brown wings and a submarginal row of prominent white dashes on the upper surface (Fig. 3, Plate C) of each wing: five dashes and a trace of a sixth on each forewing in interneural spaces 1 to 6 and six dashes on each hindwing in spaces 1 to 6. These dashes contrasted markedly with the dark brown background and were distinct from the normal white fringes which were chequered where brown scales extended along the wing nervures. They were rendered more prominent by a reduction in size and number of the usual orange lunules which appeared as mere traces on the forewings in spaces 2 and 3, and as inconspicuous marks on the hindwings in spaces 1 to 3 plus a trace in space 4 (ab. *semi-allous,* Harrison, 1906). The orange traces were not obvious in the field and were more readily recognised later in the magnified image from the projected colour slides. In addition, on the upper surface, the black discal spots were surrounded by a white halo (ab. *albi-annulata,* Harrison, 1906, = *snellini,* ter Haar), and there was a corresponding faint white spot on each hindwing (ab. *sub-quadripunctata,* Harrison, 1906). These last two features occur not uncommonly throughout the Durham range and together were named ab. *garretti* nov. by Carter & Harrison (1929) after Dr F.C. Garrett who caught the original specimen at Hawthorn Dene in July 1928. On the underside (Fig. 4, Plate C) there was a minimal reduction in the usual black markings of the white spots, and in particular on the hindwing the black centre of the white spot in space 6 was obsolescent and that in the discal scar was lacking (ab. *carteri,* Harrison, 1928). Initially the specimen was thought to be a male because of the appearance of the tip of the abdomen, but, as pointed out by Høegh-Guldberg (1966), this is an unreliable means of sexing freshly emerged individuals and later examination of the projected slides revealed the segmented tarsi of a female.

Nature of the aberration

In order to appreciate the derivation of the white dashes it is necessary to consider the anatomical location, colour and composition of the sub-marginal lunules in normal individuals and in other aberrations. Most popular texts do not describe the lunules in any detail and do not refer to any white component (Howarth, 1973). Some recent standard texts (Emmet & Heath, 1989) mention that lunules on the hindwings may comprise three components – an inner orange patch which partly encloses a dark brown spot which in turn distally is white edged. This white component on the hindwing was mentioned by Tutt (1914), who stated that occasionally a slight, but very distinct outer edging of white may be found beyond the black spots, and this was designated ab. *albsignata* n. He further commented that traces of it are very frequently to be seen with a lens.

Tutt also quotes Hodgson who had observed that the white edging may occur not uncommonly in both sexes, though more rarely in the male, occasionally though rarely on all the wings, but usually only on the hindwing and at the anal angle of the forewing. Harrison and Carter recognised the occurrence in Durham of certain specimens (ab. *vedrae,* Harrison) with these white dashes on the hindwing and Harrison designated this form as ab. *albimaculata* (Harrison, 1905). Høegh-Guldberg (1966), whilst studying the North European groups of *Aricia* species, noted that *albisignata* is not uncommon in either sex in *A. agestis* in Denmark and Sweden and in Denmark occurred in 25 to 50 percent of *A. allous* ssp. *vandalica,* Kaaber & Høegh-Guldberg (1961), in 30 percent of *A. allous* from Norway, and, depending upon the localities, in about 1 to 25 percent in *A. allous* from Sweden. Tutt also refers to the difference in frequency and degree of *albisignata* depending upon the *Aricia* species and its locality and remarks that specimens from Turkestan in the British Museum include some conspicuous examples, but that they have no white on the forewings and have a good deal of orange, especially on the hindwing. This is unlike the present Pittington Hill specimen.

Personal examination of an additional 1,319 specimens of *Aricia* species (see below) has revealed that all three components are not invariably present on the hindwings and may very occasionally occur also on the forewings. When present on the hindwings the distal (outer) component is frequently some shade of orange rather than pure white. When present on the hind or forewings the distal component is normally associated with an orange patch and dark spot so that the latter is enclosed by orange. The aberration in the

Pittington Hill specimen appears to have arisen as a result of a breakdown of this normal close relationship between the individual components of the lunules. There is a paradoxical undue development of the white distal elements forming dashes when the orange component is very reduced or absent altogether. The cause of the aberration is uncertain. Jarvis (1958) suggested that any reduction in orange lunules may be related to exposure of the mature larva or the pupa to low temperatures, but Høegh-Guldberg (1966) could not confirm this in his studies which indicated that heredity rather than environment determines the degree of lunulation. The paradoxical behaviour of the white and orange components of the lunules in the present aberration suggests that there are separate controlling genetic factors for each component. Jarvis (1974) also noticed a progressive loss of black pupillation on the underside spots with increasing duration of experimental exposure of pupae to low temperatures. Possibly some environmental factors, such as an unusual low temperature at a critical period, could have affected the relative dominance of the orange and white components of the upper surface lunules.

Frequency of aberration

It would appear that the aberration with marked white dashes is rare and is not described in the standard books on aberrations of British butterflies (Frohawk, 1938; Russwurm, 1978) or in the older literature concerning variations in County Durham (Harrison, 1906 & 1929; Carter, 1922; Carter & Harrison, 1929). Since 1979 I have observed several hundreds of these butterflies at inland and coastal locations in County Durham and this is the only one of its kind I have encountered. Sam Ellis (1991), who has a greater experience of this species in County Durham informs me that he does not know of a similar example.

In order to check further I have examined an additional 1,319 Brown Argus and Northern Brown Argus butterflies in collections at Sunderland Museum (1,083 specimens) and the Hancock Museum, Newcastle-upon-Tyne (199 specimens), together with 37 of my own collection (19 specimens plus photographs) Table 1. The museum collections include specimens dating back to the first part of this century (including those of Carter and Harrison) when the fashion to collect aberrations was probably at its height. Examination of 760 *A. artaxerxes salmacis* specimens, of which 675 were from County Durham (and the remainder from Cumbria, Westmorland and Yorkshire) failed to reveal another example of the aberration with white dashes and reduced orange lunules. Likewise none was present amongst 274 specimens of *A. agestis* from Southern England and Wales or 52 specimens from abroad (including examples of *A. agestis, A. artaxerxes allous* and *A. artaxerxes allous* ssp. *vandalica*. However, inspection of 92 specimens of *A. artaxerxes artaxerxes* from Scotland revealed a single additional example of the aberration.

Table 1.
Summary of sources of 1,319 additional specimens of *Aricia* species examined.

Place of origin	Species	Number	*Collection
County Durham		675	
Coastal	*A. artaxerxes artaxerxes*	92	SM 90, HE 2
Coastal	*A. artaxerxes salmacis*	345	SM 313, HE 32
Inland	*A. artaxerxes salmacis*	185	SM 184, HE 1
Mixed	*A. artaxerxes salmacis*	53	HM 53
Cumbria/Yorkshire	*A. artaxerxes salmacis*	85	SM 46, HM 39
S. England/ S. Wales	*A. agestis*	274	SM 213, HM 59, HE2
Scotland	*A. artaxerxes artaxerxes*	92	SM 67, HM 25
Overseas	*A. argestis & A. allous*	52	SM 52
Indeterminate	*A. a. salmacis* (mostly)	141	SM 118, HM 23

*Collections: SM and HM, Sunderland and Hancock Museums;
HE, personal specimens and photographs.

Description of the Scottish specimen

The specimen, preserved in the collection of T. Jefferson at the Sunderland Museum, carries a data label giving the location as Nigg Sutor (in north-east Scotland) and the date as 9th July 1910. Emmet & Heath (1989) indicate in the distribution map that records for this area were pre-1940. The specimen is typical of *A. artaxerxes artaxerxes,* with white discal spots on the upper surface of the forewings and reduced black spots on the underside ocelli, but there are prominent white submarginal dashes in spaces 1 to 6 on the hindwings accompanied by some orange component in spaces 1 to 4 and white blurred dashes in spaces 1 to 6 on the forewings with a mere trace of orange accompanying those in spaces 1 to 4. The blurring of the white dashes, particularly in space 4 to 6 where the white extends onto the adjacent wing surfaces near the apices, is not a feature of the Pittington Hill specimen but the basic underlying aberration would appear to be the same.

Nomenclature

A search of the literature has revealed the description of a similar aberration. Kaaber and Høegh-Guldberg (1961) reported a subspecies of *A. allous,* Hb., which they designated *A. allous* Hb. ssp. *vandalica* nov. One of their specimens (female) had white submarginal dashes on the upper surface of all four wings and they designated this f. *pan-albisignata* nov. Their colour plate shows white dashes in spaces 1 to 4 of the hindwings but those on the forewings are relatively inconspicuous and each dash is accompanied by an orange patch. Høegh-Guldberg (1966) subsequently reported a further two females of this subspecies with the same aberration (combined incidence, 3 in 377 (0.9 percent) specimens). The changes illustrated were not as striking as in the Pittington Hill or Scottish specimens. Nevertheless, the basic aberration is the same and it seems appropriate to apply the term ab. *pan-albisignata,* Kaaber & Høegh-Guldberg, to describe it. The other features, particularly the obsolescence of the orange patches and the dark brown ground colour, contribute to the overall striking appearance, but, as pointed out by Carter (1922), a specimen is best named from the predominant aberration, otherwise nomenclature becomes too complicated. In the present case it would be ab. *pan-albisignata – semi allous – sub quadripunctata,* simply to account for the upper surface.

The present aberration should not be confused with colour changes in the usual inner orange patches on the hind and forewings which occurs in ab. *pallidior,* Oberthür (pale lunules, Fig. 17, Pl. 8, Russwurm) and ab. *graafii,* ver Huell (white lunules, Fig. 16, Pl. 8, Russwurm). There were eight examples of these colour changes amongst the Sunderland collection of *A. artaxerxes salmacis* from Cumbria, but in none of these were there any distal white dashes.

Furthermore, it should be stressed that the aberration under discussion affects the upper surface for there is sometimes a prominent white band on the undersurface between the orange lunules and the wing margin as described by Høegh-Guldberg (1966) and designated by him f. *pan-albolimbata* nov.

Further observations on submarginal dashes

Whilst examining the Sunderland Museum collection for possible examples of the Pittington Hill aberration I was impressed by some specimens which had pale orange or white outer components to the lunules on the hindwings and, less frequently, on the forewings, but with accompanying inner orange patches. Therefore I re-examined the Sunderland and my own material to determine the frequency of these phenomena in relation to locality and *Aricia* species. I have allocated each specimen to one of three main categories:- (1) orange or pale orange outer component to hindwing lunules; (2) pure white dashes forming outer hindwing component *ie*, ab. *albisignata*; and (3) pure white outer white dashes on hind and forewings *ie*., ab. *pan-albisignata*. There were some difficulties because of the presence of trace amounts of the outer components visible at higher magnifications and sometimes in deciding the colour of the outer component. For the present purpose it was decided to include only those specimens with features of each category visible to the naked eye, and the dashes had to be pure white to be designated ab. *albisignata* or ab. *pan-albisignata*. Since all the specimens were treated alike the data obtained should permit valid comparisons between the different species and localities.

The results based on the examination of 989 specimens are summarised in Table 2. The orange or pale orange outer component occurred on the hindwings of some individuals of all the *Aricia* species, but pure white dashes of ab. *albisignata* were less frequent and, with the exception of the County Durham inland specimens of *A. artaxerxes salmacis,* ab. *pan-albisignata* was uncommon. The Durham coastal colonies are hybrid groups

Table 2.
Incidence and type of outer lunular components according to place of origin and *Aricia* species in 989 specimens.

Place of origin (Species)	Number	Outer lunular component		
		hindwing orange/pale	*albisignata*	*pan-albi signata*
Durham County				
Coastal (*A. a. artaxerxes*)	92	13 (14.1%)	0	0
Coastal (*A. a. salmacis*)	385	46 (11.9%)	0	0
Coastal (combined)	477	59 (12.4%)	0	0
Inland (combined) (*A. a. salmacis*)	144	46 (31.9%)	5 (3.5%)	14 (9.7%)
Inland Sherburn/Shadworth	132	36 (27.3%)	5 (3.8%)	14 (10.6%)
Total Durham	621	105 (16.9%)	5 (0.8%)	14 (2.3%)
Cumbria & Yorkshire (*A. a. salmacis*)	46	11 (23.9%)	0	0
Southern England (*A. agestis*)	205	82 (40.0%)	1 (0.5%)	0
South Wales (*A. agestis*)	10	0	0	0
Scotland (*A. a. artaxerxes*)	67	9 (13.4%)	0	*1 (1.5%)
Overseas				
** *A. agestis*	18	8 (44.4%)	0	0
*** *A. allous*	22	8 (36.4%)	0	0

*Nigg Sutor specimen described in text.
**Pyrenees (8), Portugal (2), Asia Minor (8).
***Italy (4), Bulgaria (4), Austria (5), N.W. Jutland, ssp. *vandalica*, (9).

(Dunn & Parrack, 1986) of the two *artaxerxes* subspecies *A. a. salmacis* and *A. a. artaxerxes* but the incidence of hind and forewing outer markings was the same in both these and in the specimens of *A. a. artaxerxes* from Scotland. The one Scottish exception with extreme ab. *pan-albisignata* has been described above. *A. a. artaxerxes* constitutes about 5 percent of the population on the Durham coast and is due to the presence of a single recessive gene (Jarvis, 1974). The relatively large number of such specimens available for examination (Tables 1 and 2) reflects the interest of past local collectors.

The inland Durham colonies are all *A. a. salmacis* and are notably different from those at the coast with a greater incidence of outer lunular components on the hind and forewings together with the occurrence of ab. *albisignata* and especially of ab. *pan-albisignata*. The appearances of the latter were similar to those described by Kaaber & Høegh-Guldberg (1961) with accompanying orange patches and were not as striking as those of the Pittington Hill and the Scottish Nigg specimens. The specimens of *A. a. salmacis* from Cumbria and Yorkshire did not include any examples of ab. *albisignata* or ab. *pan-albisignata*. Specimens of *A. agestis* from South England had a higher incidence of the orange or pale orange outer component on the hindwings but ab. *albisignata* was rare and ab. *pan-albisignata* was not found. The incidence of the hindwing outer component was remarkably similar throughout twelve counties (from 33.3 to 44.4 percent). Three specimens (one from Royston, Hertfordshire dated 1925 and two from Folkestone, Kent dated 1923) showed pale orange outer components on both the hind and forewings. The only ab. *albisignata* was from Chipstead, Surrey dated 1923.

The main interest centres on the County Durham inland specimens from Sherburn and nearby Shadworth with the highest incidence of ab. *albisignata* and ab. *pan-albisignata.* As with any retrospective study there are problems in knowing whether the collections are representative of wild populations. One suspects that the high incidence of the aberration in inland locations in comparison with coastal locations is genuine for collectors in the past would surely have been equally interested in collecting "variations" at the coast as inland. The presence of so many *A. a. artaxerxes* specimens in the coastal collections supports this view. It is perhaps significant too that the original specimen which stimulated my interest in these matters was observed at an inland site at Pittington Hill, which is only about 2.8km from Sherburn. All the inland populations are separated from those at the coast (for example, at Blackhall and Castle Eden Denemouth) by a distance of about 10.3km.

Possible effects of white dashes

It is unclear whether the presence of prominent white dashes has any beneficial or adverse affects for the individual. The normal wing markings play an important role in the well-being of a colony, for example, by facilitating recognition between individuals of the same species (and hence mating). Also *Aricia* species bask with open wings and in more northern latitudes there are fewer orange lunules (Smyllie, 1992) which facilitates heat absorption and presumably makes them less conspicuous to predators whilst basking. The amount of white contributed by the white dashes must be too small to significantly interfere with absorption, but could possibly render the individual more conspicuous to predators whilst basking.

Summary and conclusions

Ab. *pan-albisignata,* Kaaber & Høegh-Guldberg, occurs in several species of *Aricia*. Lesser degrees with obvious associated inner orange patches are not that uncommon in certain species and localities – notably in inland colonies of the Durham Argus, *A. artaxerxes salmacis,* Stephens. Rarely the submarginal white dashes are very marked and there is a paradoxical reduction in the inner orange patches as described in two specimens, one of *A. a. salmacis* from Pittington Hill in County Durham and the other of *A. a. artaxerxes* from Nigg in Scotland. Complete absence of the inner orange patches would serve to give maximum emphasis to the white dashes, but I have no knowledge of such a specimen.

In the past, attention has been given to the geographical variation in wing submarginal lunulation, including the presence of ab. *albisignata,* as a means of investigating the possible relationship between North European groups of

A. allous and *A. agestis* (Høegh-Guldberg, 1966). Most workers, however, have concentrated on the inner orange lunular component in similar studies (Jarvis, 1969; Smyllie, 1992). Further studies of the outer lunular component and its aberrations might prove to be useful in improving our understanding of the possible relationship between the different species and subspecies of *Aricia*. Caution is needed in interpreting the data, however, since opinions differ as to whether variation in wing lunulation occurring in different localities is the result of hybridisation between species (Smyllie, 1992) or is a response to geographic isolation of good species associated with differing environments (Shreeve, 1993).

Acknowledgement

I am grateful to Les Jessop, Keeper of Biology, Tyne & Wear Museums, for his help and permission to examine the collections at the Sunderland Museum and Art Gallery and at the Hancock Museum, Newcastle-upon-Tyne.

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Notes on the illustrations

Fig. 3, Plate C. Northern Brown Argus, Pittingham Hill, Co. Durham, 27.6.94 – upper surface, white submarginal dashes on all wings (ab. *pan-albisignata*), white discal spot with black centre on forewing and faint white on hindwing (ab. *sub-quadripunctata*), reduced orange patches (ab. *semi-allous*).

Fig, 4, Plate C. Same – under surface, reduced black central mark of hindwing discal scar and of spot in space 6.

Drepana binaria Hufn. (Lep.: Drepanidae) a third generation

This moth is described as being bivoltine in England and Wales, with a first generation in May and June, and a second in July and August, except that Barrett (*The Lepidoptera of the British Islands,* 1893) gives August and early September for a partial second generation; L. and K. Evans (*A Survey of the Macro-lepidoptera of Croydon and north-east Surrey,* 1973) and Chalmers-Hunt (*The Butterflies and Moths of Kent,* 1968) state that the second generation is the more numerous, and the records of my garden m.v. trap support this. J. Heath (Ed) (*The Butterflies and Moths of Great Britain and Ireland,* Vol. 7(b), 1992) mentions that there is an occasional small emergence in late October, but offers no evidence for the statement.

What may be representatives of a small third generation of *D. binaria* have appeared at my garden trap in four of the last five years, and two singletons in earlier years. In 1990 I recorded an early first generation in May and a prolific second generation from 13th July to 4th August, if the seven specimens noted from 20th to 31st August be regarded as their progeny; the light was operated nightly after 4th August until 3rd September when it was discontinued until October. However, the curious gap in records between 4th and 20th August may have been coincidental, all the specimens being of the second generation. The following cases refer to September moths which appeared after a considerably longer hiatus.

In 1992 second generation specimens were noted from 5th July until 8th August, to be followed by fresh looking specimens on 9th, 15th and 17th(4) September. In 1993 the second generation was in evidence from 13th July to 8th August, and was followed by a singleton on 9th September. In 1994 the last August specimen on 10th August was followed by moths on 4th, 23rd (3), and 24th September.